

CPC**COOPERATIVE PATENT CLASSIFICATION****F22B**

METHODS OF STEAM GENERATION; STEAM BOILERS (steam engine plants where engine aspects predominate [F01K](#); domestic central-heating systems using steam [F24D](#); heat exchange or heat transfer in general [F28](#); generation of vapour in the cores of nuclear reactors [G21](#))

NOTE

This subclass covers only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes

General aspects of, or methods for, steam generation**F22B 1/00**

Methods of steam generation characterised by form of heating method (solar heating [F24J](#); jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, see the subclasses for such apparatus)

F22B 1/003

- . {using combustion of hydrogen with oxygen (power plants using steam created by combustion of hydrogen with oxygen [F01K 25/005](#))}

F22B 1/006

- . { using solar heat (solar heat collectors per se [F24J 2/00](#); devices for producing mechanical power from solar energy [F03G 6/00](#))}

F22B 1/02

- . by exploitation of the heat content of hot heat carriers

F22B 1/021

- .. {with heating tubes in which flows a non-specified heating fluid (for nuclear reactors [F22B 1/023](#), for hot gas [F22B 1/1884](#))}

F22B 1/023

- .. {with heating tubes, for nuclear reactors as far as they are not classified, according to a specified heating fluid, in another group}

F22B 1/025

- ... {with vertical U shaped tubes carried on a horizontal tube sheet}

F22B 1/026

- ... {with vertical tubes between to horizontal tube sheets}

F22B 1/028

- .. {Steam generation using heat accumulators ([F22B 27/14](#) takes precedence)}

F22B 1/04

- .. the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks

F22B 1/06

- .. the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium

F22B 1/063

- ... { for metal cooled nuclear reactors (heat-exchangers having a liquid metal as heat exchange medium [F28D 7/00C](#))}

F22B 1/066

- {with double-wall tubes having a third fluid between these walls, e.g. helium for leak detection (heat-exchangers with double-wall tubes [F28D 7/10](#); double-wall pipes per se [F16L 9/18](#))}

F22B 1/08

- .. the heat carrier being steam

F22B 1/10

- ... released from heat accumulators

F22B 1/12

- ... produced by an indirect cyclic process

F22B 1/123

- {Steam generators downstream of a nuclear boiling water reactor}

F22B 1/126

- {Steam generators of the Schmidt-Hartmann type}

F22B 1/14

- ... coming in direct contact with water in bulk or in sprays

- F22B 1/143 {in combination with a nuclear installation}
- F22B 1/146 {Loffler boilers}
- F22B 1/16 .. the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour
- F22B 1/162 . . . {in combination with a nuclear installation}
- F22B 1/165 . . . {using heat pipes (heat pipes per se **F28D 15/00B**)}
- F22B 1/167 . . . {using an organic fluid}
- F22B 1/18 .. the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines (use of waste heat of combustion engines, in general, [F02G](#))
- F22B 1/1807 . . . {using the exhaust gases of combustion engines}
- F22B 1/1815 {using the exhaust gases of gas-turbines}
- F22B 1/1823 . . . {for gas-cooled nuclear reactors}
- F22B 1/183 . . . {in combination with metallurgical converter installations}
- F22B 1/1838 . . . {the hot gas being under a high pressure, e.g. in chemical installations}
- F22B 1/1846 {the hot gas being loaded with particles, e.g. waste heat boilers after a coal gasification plant}
- F22B 1/1853 . . . {coming in direct contact with water in bulk or in sprays}
- F22B 1/1861 . . . {Waste heat boilers with supplementary firing}
- F22B 1/1869 . . . {Hot gas water tube boilers not provided for in [F22B 1/1807](#) - [F22B 1/1861](#)}
- F22B 1/1876 {the hot gas being loaded with particles, e.g. dust (with the hot gas being under high pressure [F22B 1/1846](#))}
- F22B 1/1884 . . . {Hot gas heating tube boilers with one or more heating tubes}
- F22B 1/1892 . . . {Systems therefor not provided for in [F22B 1/1807](#) to [F22B 1/1861](#)}
- F22B 1/20 . . using heat evolved in a solution absorbing steam; Soda steam boilers
- F22B 1/22 . . using combustion under pressure substantially exceeding atmospheric pressure
- F22B 1/24 .. Pressure-fired steam boilers, e.g. using turbo-air compressors actuated by hot gases from boiler furnace
- F22B 1/26 .. Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised{ e.g. water in sprays}
- F22B 1/265 . . . {the water being in bulk}
- F22B 1/28 . . in boilers heated electrically {(superheating using an electrical heat source independent from heat supply of the steam boiler [F22G 1/165](#))}
- F22B 1/281 .. {other than by electrical resistances or electrodes}
- F22B 1/282 .. {with water or steam circulating in tubes or ducts}
- F22B 1/284 .. {with water in reservoirs}
- F22B 1/285 . . . {the water being fed by a pump to the reservoirs}
- F22B 1/287 .. {with water in sprays or in films}
- F22B 1/288 .. {Instantaneous electrical steam generators built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls}
- F22B 1/30 .. Electrode boilers
- F22B 1/303 . . . {with means for injecting or spraying water against electrodes or with means for water circulation}
- F22B 1/306 {with at least one electrode permanently above the water surface}

F22B 3/00 **Other methods of steam generation; Steam boilers not provided for in other groups of this subclass**

- F22B 3/02 . involving the use of working media other than water
- F22B 3/04 . by drop in pressure of high-pressure hot water within pressure- reducing chambers, e.g. in accumulators ([steam accumulators per se F01K 1/00](#))
- F22B 3/045 .. {the drop in pressure being achieved by compressors, e.g. with steam jet pumps}
- F22B 3/06 . by transformation of mechanical, e.g. kinetic, energy into heat energy
- F22B 3/08 . at critical or supercritical pressure values

Kinds of steam boilers

F22B 5/00 **Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas**

- F22B 5/005 . {with rotating drums}
- F22B 5/02 . with auxiliary water tubes outside the boiler body
- F22B 5/04 . Component parts thereof; Accessories therefor ([covers or similar closure members F16J 13/00](#))

F22B 7/00 **Steam boilers of furnace-tube type, i.e. the combustion of fuel being performed inside one or more furnace tubes built-in in the boiler body**

- F22B 7/02 . without auxiliary water tubes
- F22B 7/04 . with auxiliary water tubes
- F22B 7/06 .. inside the furnace tube in transverse arrangements
- F22B 7/08 .. inside the furnace tube in longitudinal arrangement
- F22B 7/10 .. outside the boiler body
- F22B 7/12 . with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow
- F22B 7/14 . with both auxiliary water tubes and auxiliary fire tubes
- F22B 7/16 . Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- F22B 7/18 .. Walling of flues; Flue gas header boxes
- F22B 7/20 .. Furnace tubes

F22B 9/00 **Steam boilers of fire-tube type, i.e. the flue gas from a combustion chamber outside the boiler body flowing through tubes built-in in the boiler body**

- F22B 9/02 . the boiler body being disposed upright, e.g. above the combustion chamber
- F22B 9/04 . . the fire tubes being in upright arrangement
- F22B 9/06 . . . Arrangement of header boxes providing for return diversion of flue gas flow
- F22B 9/08 . . the fire tubes being in horizontal arrangement

- F22B 9/10 . the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber
- F22B 9/12 . . the fire tubes being in substantially horizontal arrangement
- F22B 9/14 . . . Arrangement of header boxes providing for return diversion of flue gas flow

- F22B 9/16 . the boiler body containing fire tubes disposed crosswise in inclined upward arrangement

- F22B 9/18 . Component parts thereof; Accessories therefor, e.g. stay-bolt connections

- F22B 11/00 Steam boilers of combined fire-tube type and water-tube type, i.e. steam boilers of fire-tube type having auxiliary water tubes**

- F22B 11/02 . the fire tubes being in upright arrangement
- F22B 11/04 . the fire tubes being in horizontal arrangement

- F22B 13/00 Steam boilers of fire-box type, i.e. the combustion of fuel being performed in a chamber or fire-box with subsequent flue(s) or fire tube(s), both chamber or fire-box and flues or fire tubes being built-in in the boiler body**

- F22B 13/005 . { with flues, other than fire tubes}
- F22B 13/02 . mounted in fixed position with the boiler body disposed upright
- F22B 13/023 . . {with auxiliary water tubes inside the fire-box, e.g. vertical tubes (F22B 13/10 takes precedence)}
- F22B 13/026 . . . {the tubes being in substantially horizontal arrangement}
- F22B 13/04 . mounted in fixed position with the boiler body disposed substantially horizontally
- F22B 13/06 . Locomobile, traction-engine, steam-roller, or locomotive boilers
- F22B 13/065 . . {Combination of low and high pressure locomotive boilers}
- F22B 13/08 . . without auxiliary water tubes inside the fire-box
- F22B 13/10 . . with auxiliary water tubes inside the fire-box
- F22B 13/12 . . . the auxiliary water tubes lining the fire-box

- F22B 13/14 . Component parts thereof; Accessories therefor
- F22B 13/145 . . {Firebox thermosiphons}
- F22B 13/16 . . Stay-bolt connections, e.g. rigid connections
- F22B 13/18 . . . Flexible connections, e.g. of ball-and-socket type

- F22B 15/00** **Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally**
- F22B 17/00** **Water-tube boilers of horizontally-inclined type, e.g. the water-tube sets being inclined slightly with respect to the horizontal plane**
- F22B 17/02 . built-up from water-tube sets in abutting connection with two header boxes in common for all sets, e.g. with flat header boxes
- F22B 17/025 .. {with combined inlet and outlet header boxes, e.g. connected by U-tubes or Field tubes}
- F22B 17/04 .. the water-tube sets being inclined in opposite directions, e.g. crosswise
- F22B 17/06 .. the water-tube sets being bent angularly
- F22B 17/08 .. the water-tube sets being curved
- F22B 17/10 . built-up from water-tube sets in abutting connection with two sectional headers each for every set, i.e. with headers in a number of sections across the width or height of the boiler
- F22B 17/105 .. {with tubes in series flow arrangement}
- F22B 17/12 .. the sectional headers being in vertical or substantially vertical arrangement
- F22B 17/14 .. the sectional headers being in horizontal or substantially horizontal arrangement
- F22B 17/16 . Component parts thereof; Accessories therefor
- F22B 17/18 .. Header boxes; Sectional headers
- F22B 19/00** **Water-tube boilers of combined horizontally-inclined type and vertical type, i.e. water-tube boilers of horizontally-inclined type having auxiliary water-tube sets in vertical or substantially vertical arrangement**
- F22B 21/00** **Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically**
- F22B 21/002 . {involving a single upper drum ([F22B 21/36](#) takes precedence)}
- F22B 21/005 . {involving a central vertical drum, header or downcomer}
- F22B 21/007 . {specially adapted for locomotives}
- F22B 21/02 . built-up from substantially straight water tubes
- F22B 21/04 .. involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely
- F22B 21/06 ... the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape
- F22B 21/065 {involving an upper and lower drum of annular shape}
- F22B 21/08 ... the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends
- F22B 21/081 {involving a combustion chamber, placed at the side and built-up from water

- tubes}
- F22B 21/083 {involving an upper drum and a lower drum and a fire-place between the two drums}
- F22B 21/085 {the tubes being placed in layers}
- F22B 21/086 {Frames built-up from water tubes}
- F22B 21/088 { involving an upper drum and a lower drum and two lateral drums}
- F22B 21/10 . . . the water tubes being arranged in staggered rows
- F22B 21/12 . . involving two or more upper drums and two or more lower drums, e.g. with crosswise-arranged water-tube sets in abutting connections with drums
- F22B 21/123 . . . {involving crossed water tubes}
- F22B 21/126 . . . { involving more than two lower or upper drums}
- F22B 21/14 . . involving a single upper drum and two or more lower drums
- F22B 21/16 . . . the lower drums being interconnected by further water tubes
- F22B 21/18 . . involving two or more upper drums and a single lower drum
- F22B 21/185 . . . {involving more than two upper drums and a single lower drum}
- F22B 21/20 . . involving sectional or subdivided headers in separate arrangement for each water-tube set
- F22B 21/22 . . built-up from water tubes of form other than straight or substantially straight
- F22B 21/24 . . bent in serpentine or sinuous form
- F22B 21/26 . . bent helically, i.e. coiled
- F22B 21/28 . . bent spirally
- F22B 21/30 . . bent in U-loop form
- F22B 21/32 . . . disposed horizontally in abutting connection with upright headers or rising water mains
- F22B 21/34 . . built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers
- F22B 21/341 . . { Vertical radiation boilers with combustion in the lower part}
- F22B 21/343 . . . {the vertical radiation combustion chamber being connected at its upper part to a sideways convection chamber}
- F22B 21/345 {with a tube bundle between an upper and a lower drum in the convection pass}
- F22B 21/346 . . { Horizontal radiation boilers}
- F22B 21/348 . . {Radiation boilers with a burner at the top}
- F22B 21/36 . . involving an upper drum or headers mounted at the top of the combustion chamber
- F22B 21/363 . . . {involving a horizontal drum mounted in an upper corner of the boiler}
- F22B 21/366 . . . {involving a horizontal drum mounted in the middle of the boiler}
- F22B 21/38 . . Component parts thereof, e.g. prefabricated panels
- F22B 21/40 . . built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers
- F22B 23/00** **Water-tube boilers built-up from sets of spaced double-walled water tubes of return type in unilateral abutting connection with a boiler drum or with a header box, i.e. built-up from Field water tubes comprising an inner tube arranged within an outer**

unilaterally-closed tube

- F22B 23/02 . the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal
- F22B 23/04 . the water-tube, i.e. Field-tube, sets being vertical or substantially vertical
- F22B 23/06 . Component parts thereof, e.g. Field water tubes ([heat-exchange tubes in general F28F](#))

F22B 25/00 Water-tube boilers built-up from sets of water tubes with internally-arranged flue tubes, or fire tubes, extending through the water tubes**F22B 27/00 Instantaneous or flash steam boilers**

- F22B 27/02 . built-up from fire tubes
- F22B 27/04 . built-up from water tubes ([F22B 27/12 to F22B 27/16 take precedence](#))
- F22B 27/06 .. bent in serpentine or sinuous form
- F22B 27/08 .. bent helically, i.e. coiled
- F22B 27/10 .. bent spirally
- F22B 27/12 . built-up from rotary heat-exchange elements, e.g. from tube assemblies
- F22B 27/14 . built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls ([F22B 1/288 takes precedence](#))
- F22B 27/16 . involving spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements, e.g. into tubes ([F22B 1/287 takes precedence](#))
- F22B 27/165 .. {with film flow of water on heated surfaces}

F22B 29/00 Steam boilers of forced-flow type

- F22B 29/02 . of forced-circulation type ([F22B 29/06 takes precedence](#))
- F22B 29/023 .. {without drums, i.e. without hot water storage in the boiler}
- F22B 29/026 ... {operating at critical or supercritical pressure}
- F22B 29/04 . of combined-circulation type, i.e. in which convection circulation due to the difference in specific gravity between cold and hot water is promoted by additional measures, e.g. by injecting pressure-water temporarily
- F22B 29/06 . of once-through type, i.e. built-up from tubes receiving water at one end and delivering superheated steam at the other end of the tubes ([F22B 33/00 takes precedence](#))
- F22B 29/061 .. {Construction of tube walls}
- F22B 29/062 ... {involving vertically-disposed water tubes}
- F22B 29/064 ... {involving horizontally- or helically-disposed water tubes}
- F22B 29/065 ... {involving upper vertically disposed water tubes and lower horizontally- or

- helically disposed water tubes}
- F22B 29/067 .. {operating at critical or supercritical pressure (with recirculation during normal operation [F22B 29/026](#))}
- F22B 29/068 .. {operating with superimposed recirculation during normal operation ([F22B 29/12](#) takes precedence)}
- F22B 29/08 .. operating with fixed point of final state of complete evaporation ({ evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions [B01B 1/005](#))}
- F22B 29/10 .. operating with sliding point of final state of complete evaporation ({ evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions [B01B 1/005](#))}
- F22B 29/12 .. operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers

F22B 31/00 **Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements of dispositions of combustion apparatus (steam generation characterised by heating method [F22B 1/00](#); combustion apparatus per se [F23](#))**

- F22B 31/0007 . {with combustion in a fluidized bed (fluidized bed apparatus per se [B01J 8/00](#); fluidized bed combustors **F23C 11/02**)}
- F22B 31/0015 .. {for boilers of the water tube type}
- F22B 31/0023 ... {with tubes in the bed ([F22B 31/003](#) takes precedence)}
- F22B 31/003 ... {with tubes surrounding the bed or with water tube wall partitions}
- F22B 31/0038 {with tubes in the bed}
- F22B 31/0046 .. {for boilers of the shell type, e.g. with furnace box}
- F22B 31/0053 ... {with auxiliary water tubes}
- F22B 31/0061 .. {Constructional features of bed cooling}
- F22B 31/0069 .. {Systems therefor}
- F22B 31/0076 .. {Controlling processes for fluidized bed boilers not related to a particular type}
- F22B 31/0084 .. {with recirculation of separated solids or with cooling of the bed particles outside the combustion bed}
- F22B 31/0092 ... {with a fluidized heat exchange bed and a fluidized combustion bed separated by a partition, the bed particles circulating around or through that partition}
- F22B 31/02 . Installation of water-tube boilers in chimneys, e.g. in converter chimneys
- F22B 31/04 . Heat supply by installation of two or more combustion apparatus, e.g. of separate combustion apparatus for the boiler and the superheater respectively
- F22B 31/045 .. {Steam generators specially adapted for burning refuse}
- F22B 31/06 .. Installation of emergency heat supply
- F22B 31/08 . Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion

Steam-generation plants; Control systems

- F22B 33/00** **Steam-generation plants, e.g. comprising steam boilers of different types in mutual association** ([arrangements or dispositions of steam-generation plants in marine vessels B63H 21/00](#))
- F22B 33/02 . Combinations of boilers having a single combustion apparatus in common
 - F22B 33/04 .. of boilers of furnace-tube type with boilers of water-tube type
 - F22B 33/06 .. of boilers of furnace-tube type with boilers of fire-tube type
 - F22B 33/08 .. of boilers of water tube type with boilers of fire-tube type
 - F22B 33/10 .. of two or more superposed boilers with separate water volumes and operating with two or more separate water levels

 - F22B 33/12 . Self-contained steam boilers, i.e. comprising as a unit the steam boiler, the combustion apparatus, the fuel storage, accessory machines and equipment

 - F22B 33/14 . Combination of low and high pressure boilers ([F22B 13/065 takes precedence](#))
 - F22B 33/16 .. of forced-flow type

 - F22B 33/18 . Combinations of steam boilers with other apparatus
 - F22B 33/185 .. {in combination with a steam accumulator}

F22B 35/00 **Control systems for steam boilers** ({for fluidized bed boilers [F22B 31/0076](#);} regulation or control of steam power plants [F01K 7/00](#); for regulating feed-water supply [F22D](#); for controlling superheat temperature [F22G 5/00](#); control of combustion [F23N](#); regulating or controlling in general [G05](#))

 - F22B 35/001 . {Controlling by flue gas dampers (for superheaters [F22G 5/04](#))}
 - F22B 35/002 . {Control by recirculating flue gases (for superheaters [F22G 5/06](#))}
 - F22B 35/004 . {Control systems for steam generators of nuclear power plants}
 - F22B 35/005 . {Control systems for instantaneous steam boilers}
 - F22B 35/007 . {Control systems for waste heat boilers}
 - F22B 35/008 . {Control systems for two or more steam generators ([F22D 5/36 takes precedence](#))}

 - F22B 35/02 . for steam boilers with natural convection circulation
 - F22B 35/04 .. during starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers

 - F22B 35/06 . for steam boilers of forced-flow type
 - F22B 35/08 .. of forced-circulation type
 - F22B 35/083 ... {without drum, i.e. without hot water storage in the boiler}
 - F22B 35/086 {operating at critical or supercritical pressure}
 - F22B 35/10 .. of once-through type
 - F22B 35/101 ... {operating with superimposed recirculation during starting or low load periods,

- e.g. composite boilers ([F22B 35/125](#) takes precedence)}
- F22B 35/102 . . . {operating with fixed point of final state of complete evaporation, e.g. in a steam-water separator}
- F22B 35/104 . . . {Control systems by injecting water (for superheaters [F22G 5/12](#))}
- F22B 35/105 . . . {operating at sliding pressure}
- F22B 35/107 . . . {Control systems with auxiliary heating surfaces}
- F22B 35/108 . . . {Control systems for steam generators having multiple flow paths}
- F22B 35/12 . . . operating at critical or supercritical pressure
- F22B 35/125 {operating with superimposed recirculation during starting or low load periods, e.g. composite boilers}
- F22B 35/14 . . during the starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- F22B 35/16 . . responsive to the percentage of steam in the mixture of steam and water
- F22B 35/18 . Application of computers to steam boiler control

- F22B 37/00** **Component parts or details of steam boilers** (venting devices [F16K 24/00](#); steam traps or like apparatus [F16T](#))

- F22B 37/001 . {Steam generators built-up from pre-fabricated elements}
- F22B 37/002 . {specially adapted for nuclear steam generators, e.g. maintenance, repairing or inspecting equipment not otherwise provided for}
- F22B 37/003 . . {Maintenance, repairing or inspecting equipment positioned in or via the headers}
- F22B 37/005 . . . { Positioning apparatus specially adapted therefor ([F22B 37/70C3](#) takes precedence)}
- F22B 37/006 . . {Walking equipment, e.g. walking platforms suspended at the tube sheet ([walking mechanism per se B62D 57/02](#))}
- F22B 37/007 . . {Installation or removal of nuclear steam generators}
- F22B 37/008 . { Adaptations for flue gas purification in steam generators, ([flue gas purification in general F23J](#); [gas purification in general B01D](#))}

- F22B 37/02 . applicable to more than one kind or type of steam boiler
- F22B 37/025 . . {Devices and methods for diminishing corrosion, e.g. by preventing cooling beneath the dew point}
- F22B 37/04 . . and characterised by material, e.g. use of special steel alloy
- F22B 37/06 . . Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts
- F22B 37/08 . . . Fittings preventing burning-off of the tube edges
- F22B 37/10 . . Water tubes; Accessories therefor ([working of metal tubes B21D](#); [pipes in general F16L](#); [repairing leaks in water tubes F16L 55/16](#); [F28F 11/00](#); baffles, screens, or deflectors formed of water tubes [F23M 9/10](#); [cleaning internal or external surfaces of water tubes F28G](#))
- F22B 37/101 . . . {Tubes having fins or ribs}
- F22B 37/102 {Walls built-up from finned tubes}
- F22B 37/103 {Internally ribbed tubes}

F22B 37/104	...	{ Connection of tubes one with the other or with collectors, drums or distributors (in general F16L)}
F22B 37/105	...	{Penetrations of tubes through a wall and their sealing (in general F16L 5/00)}
F22B 37/106	...	{Studding of tubes}
F22B 37/107	...	{Protection of water tubes (in general F16L 57/00)}
F22B 37/108	.....	{Protection of water tube walls}
F22B 37/12	...	Forms of water tubes, e.g. of varying cross-section
F22B 37/125	.....	{Bifurcates}
F22B 37/14	...	Supply mains, e.g. rising mains, down-comers, in connection with water tubes
F22B 37/141	.....	{involving vertically-disposed water tubes, e.g. walls built-up from vertical tubes}
F22B 37/142	.....	{involving horizontally-or helically-disposed water tubes, e.g. walls built-up from horizontal or helical tubes}
F22B 37/143	.....	{Panel shaped heating surfaces built up from tubes (F22B 37/145 takes precedence)}
F22B 37/145	.....	{Flag-shaped panels built-up from tubes, e.g. from U-shaped tubes}
F22B 37/146	.....	{Tube arrangements for ash hoppers and grates and for combustion chambers of the cyclone or similar type out of the flues}
F22B 37/147	.....	{Tube arrangements for cooling orifices, doors and burners}
F22B 37/148	.....	{Tube arrangements for the roofs}
F22B 37/16	...	Return bends
F22B 37/165	.....	{Closures for access openings in return bends (boiler plugs for drums or headers F22B 37/223)}
F22B 37/18	...	Inserts, e.g. for receiving deposits from water
F22B 37/20	...	Supporting arrangements, e.g. for securing water-tube sets (construction of tube walls of furnaces including boiler furnaces F23M 5/08)
F22B 37/201	.....	{Suspension and securing arrangements for walls built-up from tubes}
F22B 37/202	.....	{Suspension and securing arrangements for contact heating surfaces}
F22B 37/203	.....	{Horizontal tubes supported only away from their ends on vertical support tubes}
F22B 37/204	.....	{Supporting arrangements for individual tubes, e.g. for securing tubes to a refractory wall}
F22B 37/205	.....	{Supporting and spacing arrangements for tubes of a tube bundle}
F22B 37/206	.....	{Anti-vibration supports for the bends of U-tube steam generators}
F22B 37/207	.....	{Supporting arrangements for drums and collectors}
F22B 37/208	.....	{Backstay arrangements}
F22B 37/22	..	Drums; Headers; Accessories therefor (making boilers from sheet metal B21D 51/24 ; pressure vessels in general F16J 12/00 ; covers or similar closure members F16J 13/00)
F22B 37/221	...	{Covers for drums, collectors, manholes or the like (in general F16J 13/00)}
F22B 37/222	.....	{Nozzle dams introduced through a smaller manway, e.g. foldable}
F22B 37/223	.....	{Boiler plugs, e.g. for handholes (closures for access openings in return bends F22B 37/165)}
F22B 37/225	...	{Arrangements on drums or collectors for fixing tubes or for connecting collectors to each other}
F22B 37/226	...	{Protection of drums against combustion}

- F22B 37/227 ... {Drums and collectors for mixing}
- F22B 37/228 ... {Headers for distributing feedwater into steam generator vessels; Accessories therefor}
- F22B 37/24 .. Supporting, suspending, or setting arrangements, e.g. heat shielding ([frames, engine beds F16M](#))
- F22B 37/242 ... {for bottom supported water-tube steam generators}
- F22B 37/244 ... {for water-tube steam generators suspended from the top}
- F22B 37/246 ... {for steam generators of the reservoir type, e.g. nuclear steam generators}
- F22B 37/248 {with a vertical cylindrical wall}
- F22B 37/26 .. Steam-separating arrangements ([vapour-liquid separators, e.g. for drying steam, B01D; B04](#))
- F22B 37/261 ... {specially adapted for boiler drums}
- F22B 37/263 ... {Valves with water separators}
- F22B 37/265 ... {Apparatus for washing and purifying steam}
- F22B 37/266 ... {Separator reheaters}
- F22B 37/268 ... {specially adapted for steam generators of nuclear power plants}
- F22B 37/28 ... involving reversal of direction of flow
- F22B 37/283 {specially adapted for boiler drums}
- F22B 37/286 {specially adapted for steam generators of nuclear power plants}
- F22B 37/30 ... using impingement against baffle separators
- F22B 37/303 {specially adapted for boiler drums}
- F22B 37/306 {specially adapted for steam generators of nuclear power plants}
- F22B 37/32 ... using centrifugal force
- F22B 37/322 {specially adapted for boiler drums}
- F22B 37/325 {using a revolving element}
- F22B 37/327 {specially adapted for steam generators of nuclear power plants}
- F22B 37/34 .. Adaptations of boilers for promoting water circulation ([{F22B 13/145 takes precedence };](#) [auxiliary devices for promoting water circulation F22D 7/00](#))
- F22B 37/36 .. Arrangements for sheathing or casing boilers
- F22B 37/365 ... {Casings of metal sheets, e.g. expansion plates, expansible joints}
- F22B 37/38 .. Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes ([measuring or indicating instruments in general G01](#))
- F22B 37/40 .. Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles ([in flues or chimneys F23J 13/00](#))
- F22B 37/42 .. Applications, arrangements, or dispositions of alarm or automatic safety devices ([for feed-water heaters F22D 1/14;](#) [{ emergency feed-water supply F22D 11/003};](#) [alarms responsive to undesired or abnormal conditions G08B](#))
- F22B 37/421 ... {Arrangements for detecting leaks}
- F22B 37/423 ... {Valves for testing steam generators}
- F22B 37/425 ... {Feed-water supply alarm devices using floats}
- F22B 37/426 ... {Feed-water supply alarm devices using electric signals}
- F22B 37/428 ... {Feed-water supply alarm devices using dilatation of solids or liquids}
- F22B 37/44 ... of safety valves ([safety valves per se F16K](#))

- F22B 37/443 {Safety devices extinguishing the fire}
- F22B 37/446 {Safety devices responsive to overpressure}
- F22B 37/46 . . . responsive to low or high water level, e.g. for checking, suppressing, extinguishing combustion in boilers ([fire-fighting, fire extinction in general A62](#))
- F22B 37/47 . . . responsive to abnormal temperature, e.g. actuated by fusible plugs ([such alarms or devices per se G08B](#))
- F22B 37/475 {Safety devices with fusible plugs}
- F22B 37/48 . . . Devices for removing water, salt, or sludge from boilers ([cleaning internal or external surfaces of water tubes F28G](#)); Arrangements of cleaning apparatus in boilers ([cleaning external surfaces of tubes by soot blowers F23J](#)); Combinations thereof with boilers
- F22B 37/483 . . . {specially adapted for nuclear steam generators}
- F22B 37/486 . . . {Devices for removing water, salt, or sludge from boilers ([F22B 37/483, F22B 37/50, F22B 37/52 and F22B 37/54 take precedence](#))}
- F22B 37/50 . . . for draining or expelling water
- F22B 37/52 . . . Washing-out devices
- F22B 37/54 . . . De-sludging or blow-down devices {([F22B 37/565 takes precedence](#))}
- F22B 37/545 {Valves specially adapted therefor ([valves in general F16K](#))}
- F22B 37/56 . . . Boiler cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down
- F22B 37/565 . . . {Blow-down control, e.g. for ascertaining proper duration of boiler blow-down}
- F22B 37/58 . . . Removing tubes from headers or drums; Extracting tools
- F22B 37/60 . . . specially adapted for steam boilers of instantaneous or flash type
- F22B 37/62 . . . specially adapted for steam boilers of forced-flow type
- F22B 37/64 . . . Mounting of, or supporting arrangements for, tube units ([construction of tube walls of furnaces, e.g. boiler furnaces F23M 5/08](#))
- F22B 37/645 . . . {involving upper vertically-disposed water tubes and lower horizontally- or helically disposed water tubes}
- F22B 37/66 . . . involving vertically-disposed water tubes ([F22B 37/645 takes precedence](#))
- F22B 37/68 . . . involving horizontally-disposed water tubes ([F22B 37/645 takes precedence](#))
- F22B 37/70 . . . Arrangements for distributing water into water tubes
- F22B 37/72 . . . involving injection devices
- F22B 37/74 . . . Throttling arrangements for tubes or sets of tubes
- F22B 37/76 . . . Adaptations or mounting of devices for observing existence or direction of fluid flow ([devices per se G01P](#))
- F22B 37/78 . . . Adaptations or mounting of level indicators ([level indicators per se G01F](#))